Tigo®

Installation Manual

TS4-F and TS4-R-F, RSS Transmitter

IMPORTANT SAFETY INSTRUCTIONS

LETHAL VOLTAGE MAY BE PRESENT IN ANY PV INSTALLATION

SAVE THESE INSTRUCTIONS

- This manual contains important instructions for installation and maintenance of the Tigo Energy® product models TS4-F, TS4-R-F, and the RSS Transmitter.
- Risk of electric shock, do not remove cover, disassemble, or repair, no user serviceable parts inside. Refer servicing to qualified service personnel.
- Before installing or using the Tigo Energy® System, please read all instructions and warning markings on the Tigo Energy products, appropriate sections of your inverter manual, photovoltaic (PV) module installation manual, and other available safety guides.
- Failure to adhere to these instructions may result in injury or death, damage to the system or voiding the factory warranty.
- To reduce risk of fire and shock hazard, install this device with strict adherence to National Electric Code (NEC) ANSI/NFPA 70 and/or local electrical codes. When the photovoltaic array is exposed to light, it supplies a DC voltage to the Tigo Energy® TS4 units. The TS4 units start in the "ON" state and their output voltage may be as high as the PV module open circuit voltage (V_{OC}) when connected to the module. The installer should use the same caution when handling electrical cables from a PV module with or without the TS4 units attached.
- Installation must be performed by trained professionals only. Tigo Energy does not assume liability for loss or damage resulting from improper handling, installation, or misuse of products.
- Remove all metallic jewelry prior to installing the Tigo Energy TS4 units to reduce the risk of contacting live circuitry. Do not attempt to install in inclement weather.
- Do not operate the Tigo Energy TS4 units if they have been physically damaged. Check existing cables and connectors, ensuring they are in good condition and appropriate in rating. Do not operate Tigo Energy TS4 units with damaged or substandard wiring or connectors. Tigo Energy TS4 units must be mounted on the high end of the PV module backsheet or racking system, and in any case above ground.
- Do not connect or disconnect under load. Turning off the Inverter and/or the Tigo Energy products may not reduce this risk. Internal capacitors within the inverter can remain charged for several minutes after disconnecting all power sources. Verify capacitors have discharged by measuring voltage across inverter terminals prior to disconnecting wiring if service is required.
- Always assume TS4 units are in "ON" state, or may turn on when restarting.

The transmitter control power supply MUST be on the same AC branch circuit as the inverter to meet rapid shutdown requirements.

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1.1 RAPID SHUTDOWN SYSTEM

Module Level Power Electronics:

TS4-F, TS4-R-F

- NEC 2017 690.12 Rapid shutdown compliant
- Module-level deactivation
- PLC SunSpec-compliant communication
- Plug & play, no configuration required

Transmitter:

RSS Transmitter

- Rapid Shutdown System transmitter for rapid shutdown activation of TS4-F or TS4-R-F units
- The external device that provides a keep-alive signal to the PVRSE device via Power Line Communication.

1.1 TS4 FIRE SAFETY PRODUCTS

- NEC 2017 690.12 Rapid shutdown compliant
- Module-level deactivation
- PLC SunSpec-compliant communication
- Plug & play, no configuration required

TS4-F

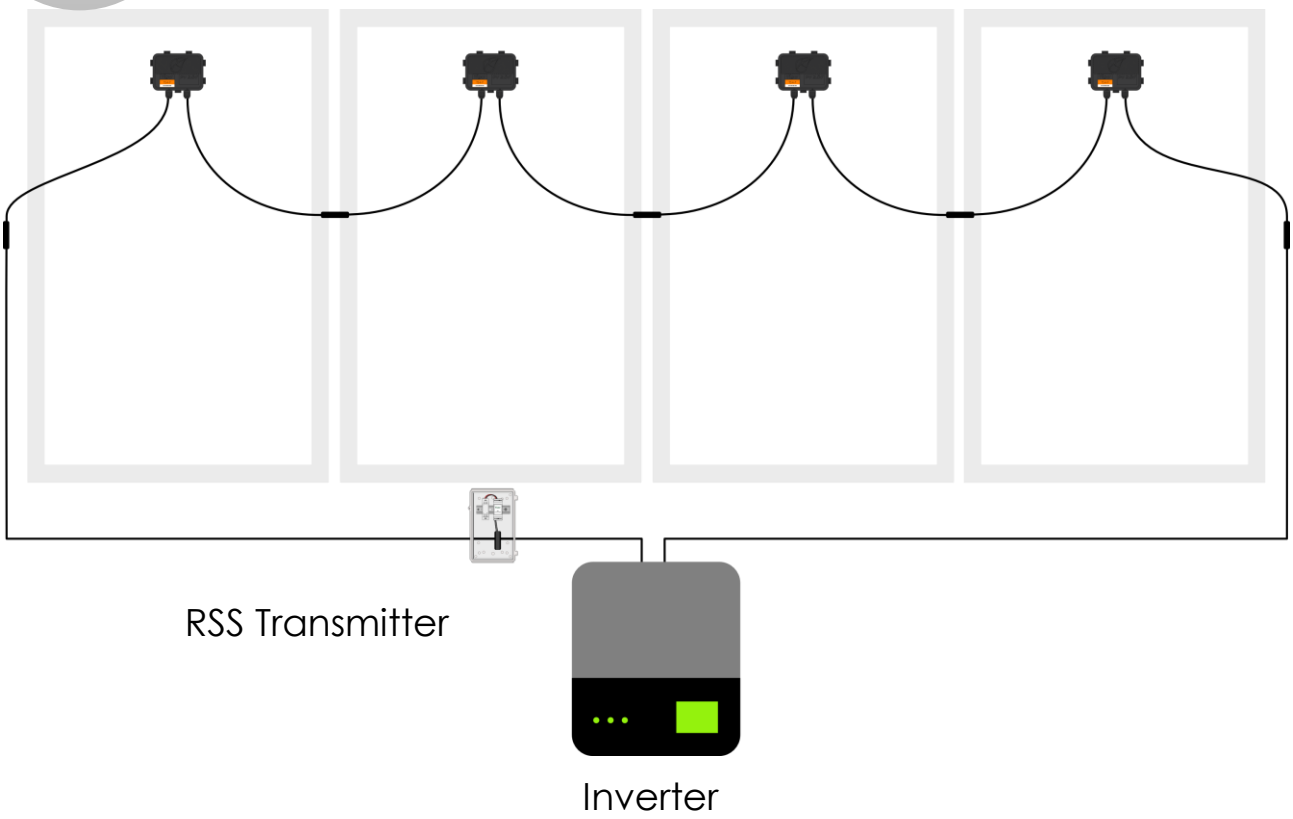
- Module electronics are contained in the junction box, installed at the PV module factory.
- Connected in series like regular modules
- No additional wiring connections to make

TS4-R-F

- Bracket clips to module frame without tools
- TS4-R-F outputs are connected in series to form a string
- No additional grounding required

1.3.1 SYSTEM OVERVIEW: TS4-F

TS4 Smart Module
Powered by Tigo



The TS4-F requires a SunSpec-compliant PLC transmitter in order to operate correctly.
The Tigo RSS Transmitter is installed in line with a solar PV inverter, as shown, and can be installed inside the inverter or external to it.
If using a SunSpec-compliant inverter, the PLC functionality is built-in and an external transmitter is not required.

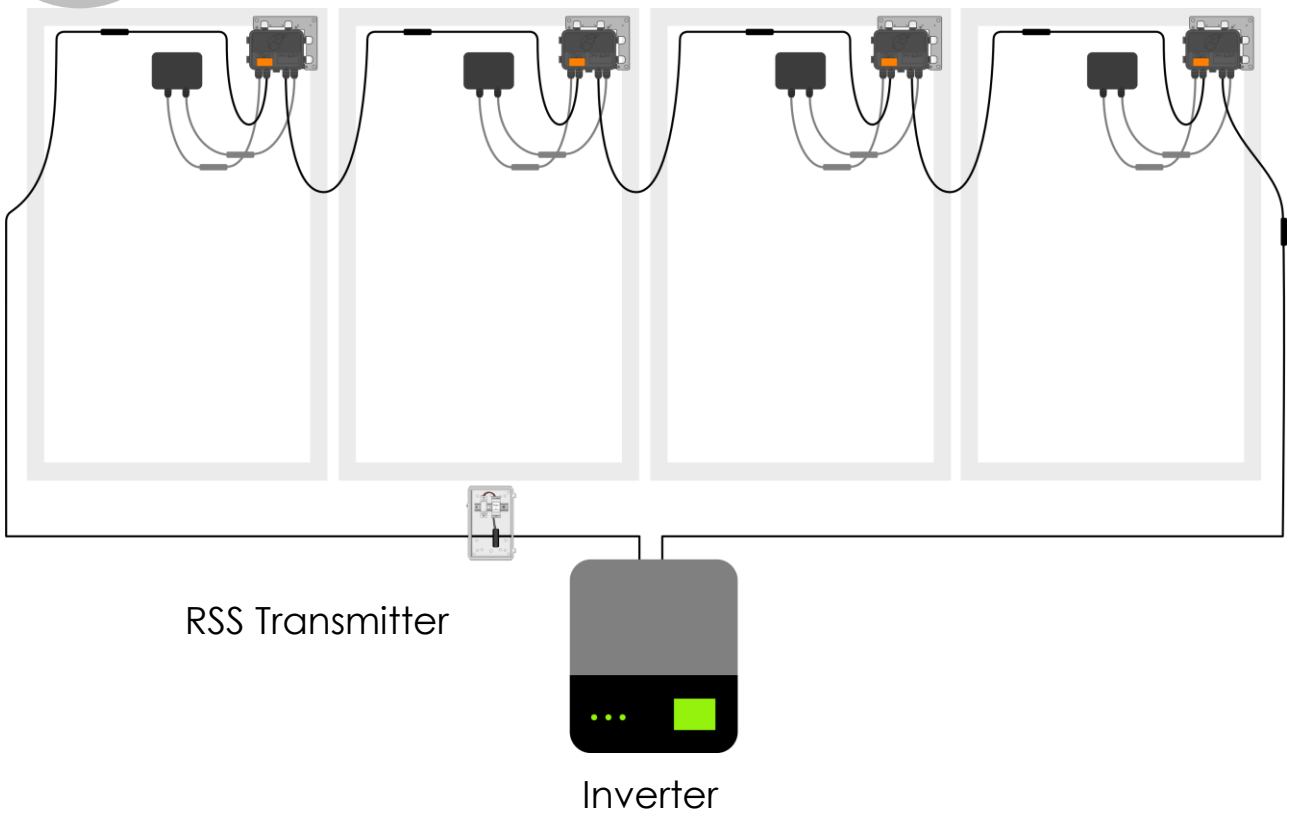
Method of Operation

TS4-F and TS4-R-F units start in the OFF position and measure 0.6V at the output. Upon connection to the SunSpec-compliant Power Line Communication (PLC) transmitter (or "initiator"), they turn ON and allow full PV module voltage.

The units constantly receive a "keep-alive" signal from the initiator over PLC. When power to the initiator is cut, this keep-alive signal vanishes, sending every TS4-F/TS4-R-F into shutdown mode with output reduced to 0.6V.

1.3.2 SYSTEM OVERVIEW: TS4-R-F

TS4-R-F Smart Module
Add-on
Powered by Tigo

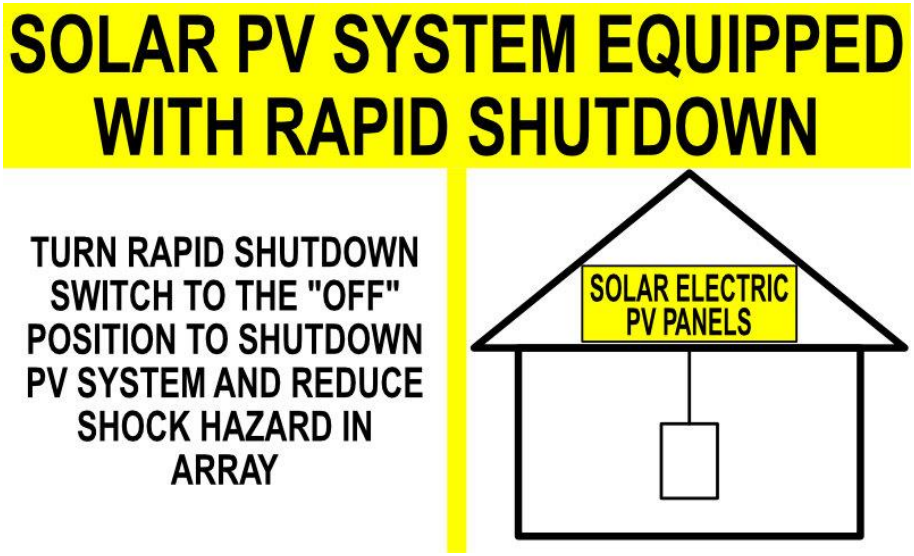


Note: connect modules to TS4-R inputs before connecting outputs

- TS4-R mounting is recommended on the upper right as shown, but can be placed on upper left if needed (due to racking constraints, etc.)
- TS4-R cable glands must not be facing up.
- Allow clearance between PV module and mounting surface for air circulation around TS4-R.
- Do not drill additional mounting holes in the frame or metal bracket.

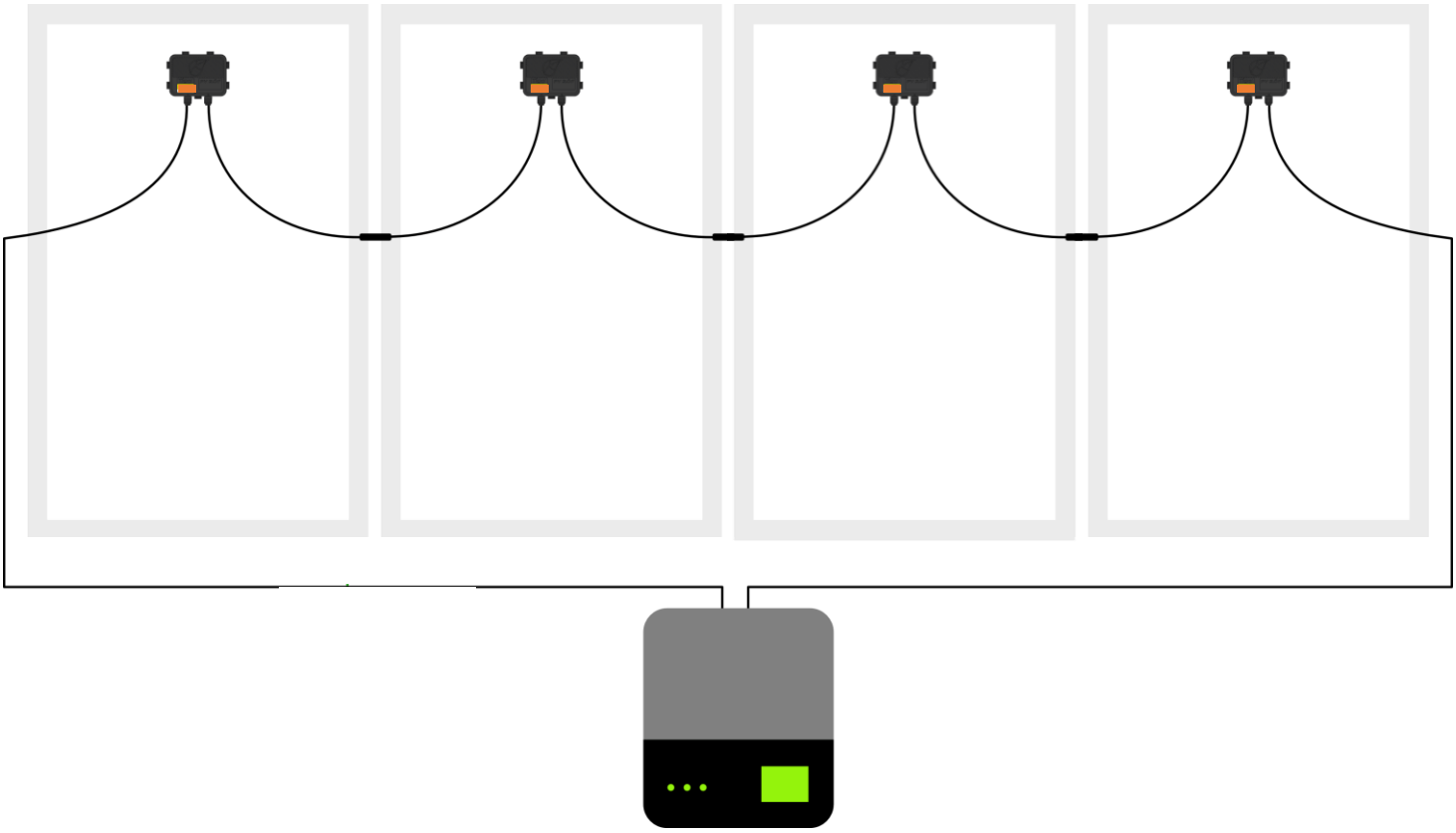
2.1 RSS INSTALLATION NOTES

- TS4-F and TS4-R-F are shipped in the OFF position and will measure **0.6V** at the output when the keep-alive signal is not present.
- Failing to follow the sequence of installation steps may result in TS4 damage not covered under warranty.
- Connect all TS4-R-F units to their respective modules before connecting their outputs in series.
- Install all TS4-F or TS4-R-F units before powering on the RSS Transmitter.
- Never apply an external voltage source to a module or string equipped with TS4-F/TS4-R-F units.
    - If parallel string connections are needed, first connect the TS4-F/TS4-R-F to the PV modules, then connect all TS4-F/TS4-R-F outputs in series, and finally pass one side (+ **or** -) of the homeruns through the PLC transmitter to turn the system ON.
- Place rapid shutdown system label no more than 1m (3ft) from initiator (AC disconnect) or service panel containing means of disconnection if not at same location.



Place Rapid Shutdown System label in proper location.

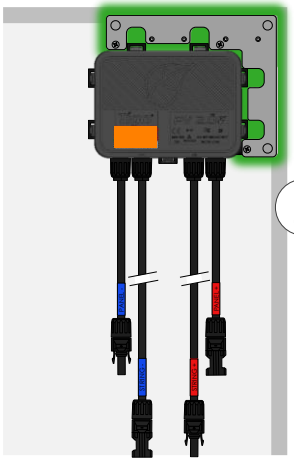
2.2 TS4-F INSTALLATION



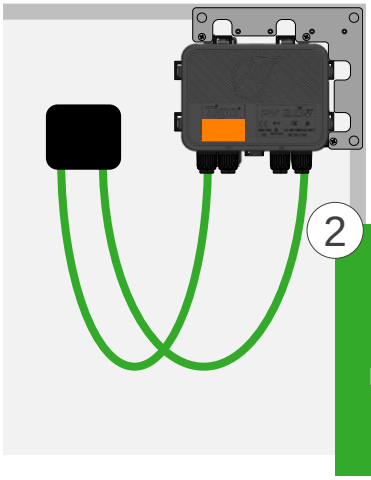
Smart modules with an integrated TS4 Junction box are installed and connected in series just like standard PV modules.

Connect modules with TS4-F in series before powering on the RSS Transmitter.

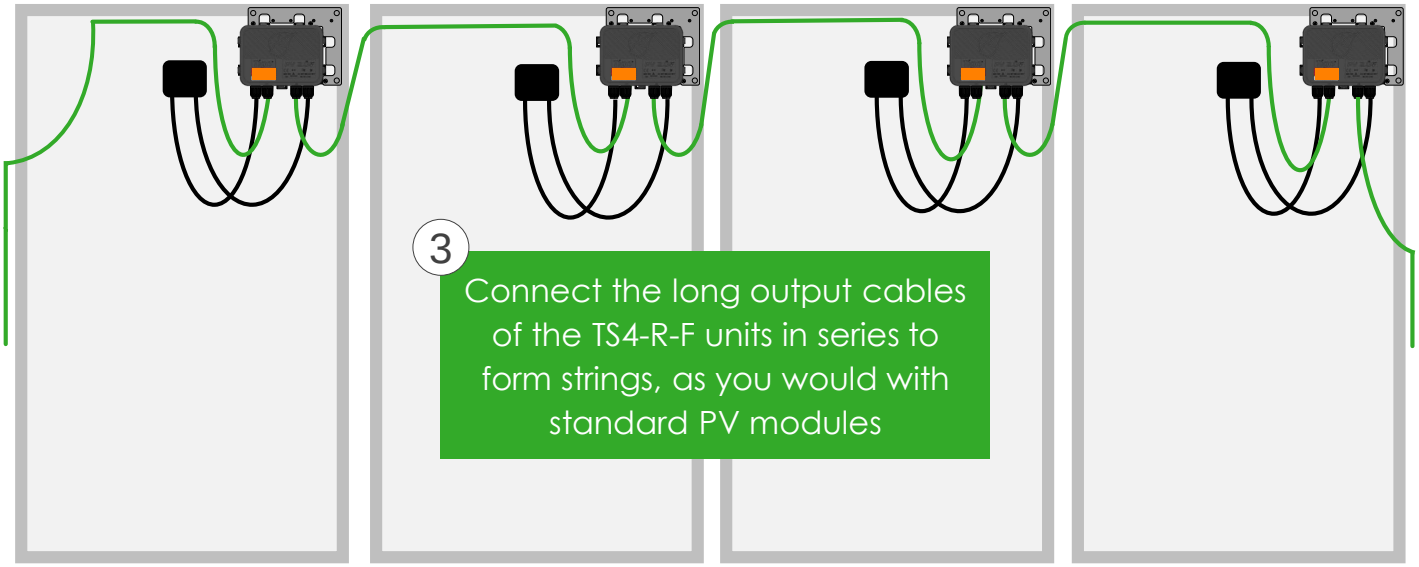
2.3 TS4-R-F INSTALLATION



1 Mount the TS4-R-F on the top right corner of a PV module



2 Connect the PV cables from the module to the short leads of the TS4-R-F



3 Connect the long output cables of the TS4-R-F units in series to form strings, as you would with standard PV modules

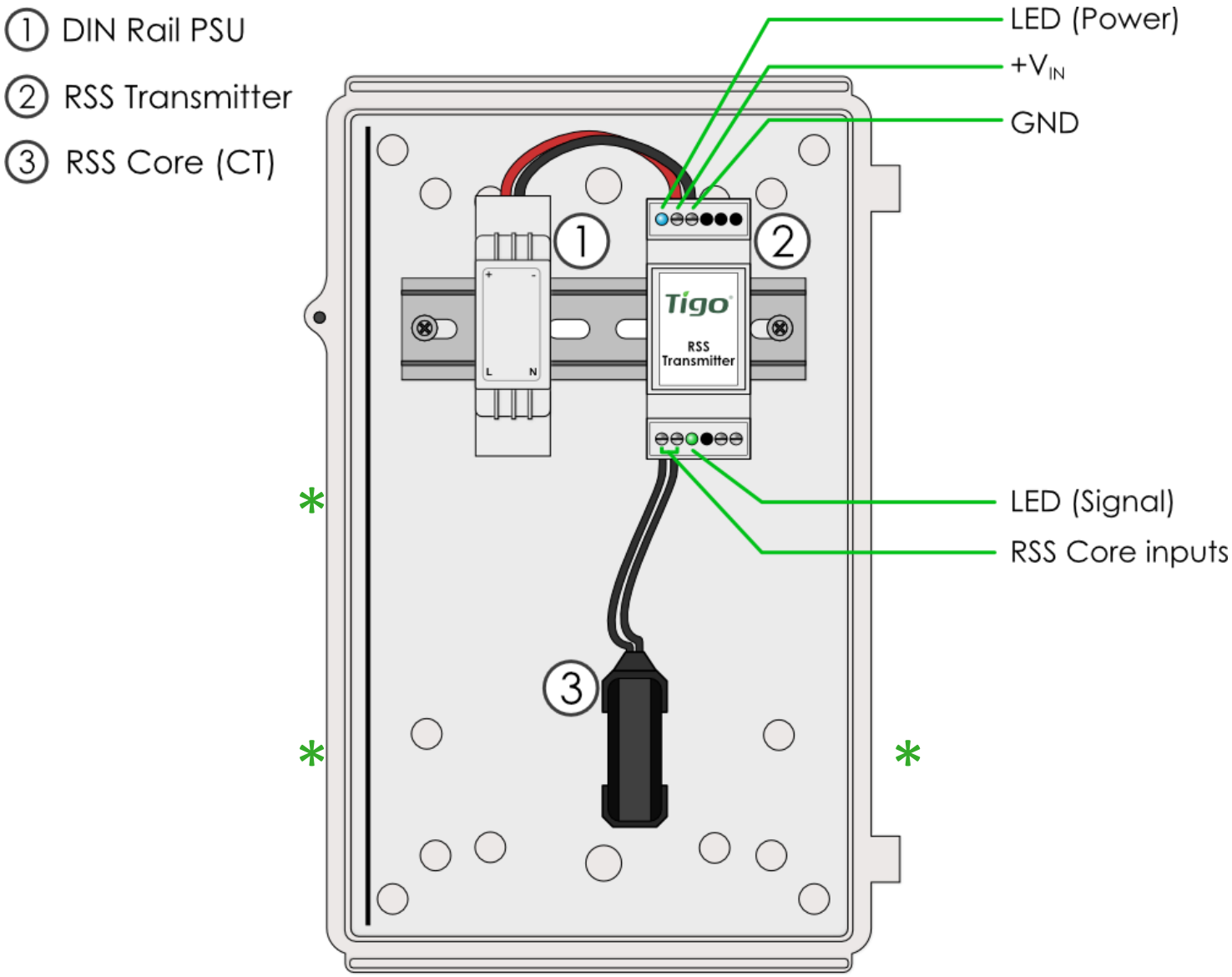
Standard modules can be equipped with TS4-R-F add-on/retrofit units as shown above.

Always connect modules to TS4-R inputs before connecting outputs.

Each TS4-R-F must have a PV module connected to its input before connecting the outputs of TS4-R-F units in series.

To disconnect TS4-R-F from a module, disconnect the TS4-R-F outputs from the string before disconnecting the TS4-R-F inputs from the module junction box.

3.1 RSS TRANSMITTER INSTALLATION

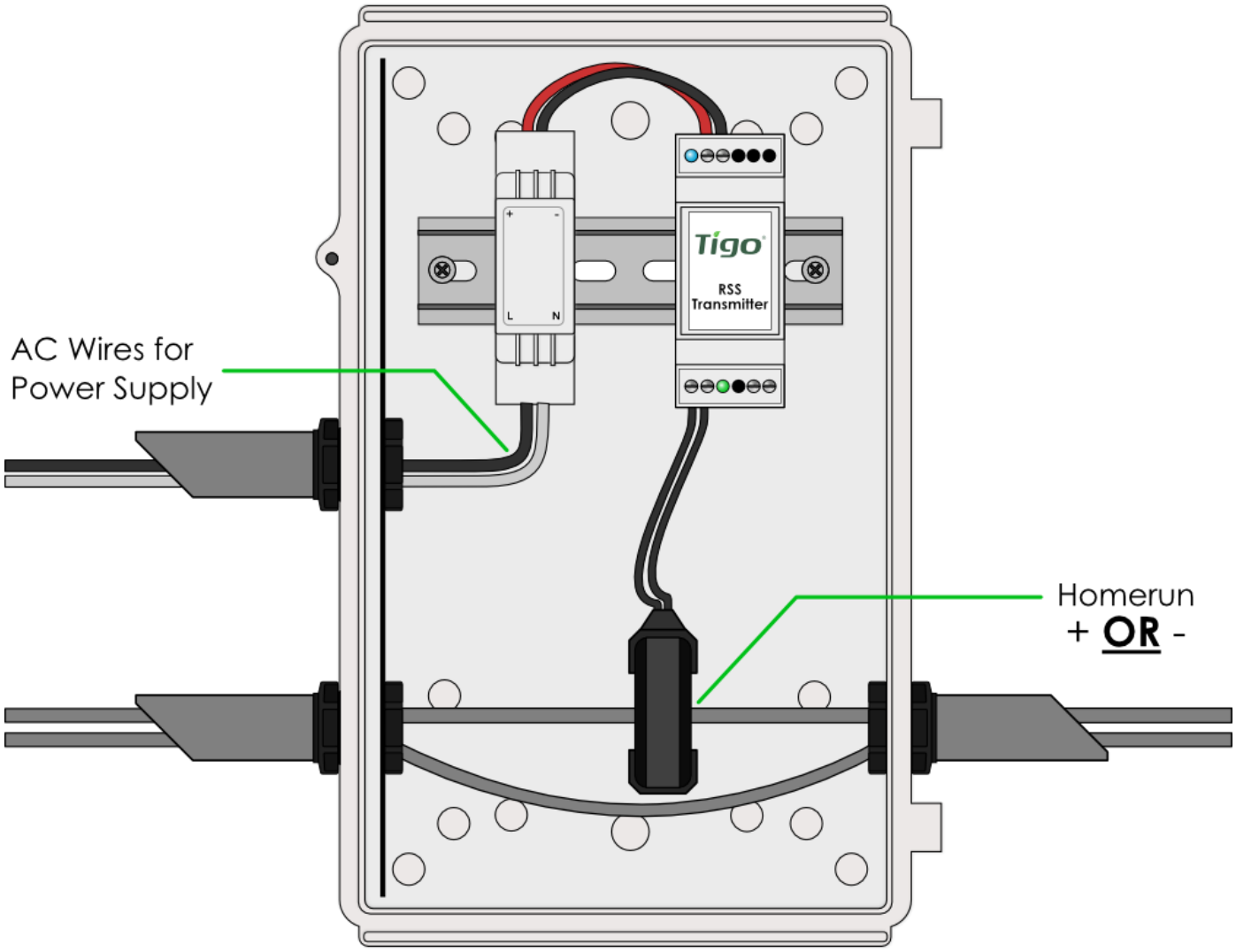


Install TS4-F **before** powering on RSS Transmitter

- Drill holes in enclosure for conduit (see appendix for placement guide)
- Mount RSS Transmitter and power supply on DIN rail
- Connect DC leads from power supply ① to transmitter ②
- Connect RSS Core ③ to transmitter

* Suggested locations for conduit

3.2 RSS TRANSMITTER WIRING



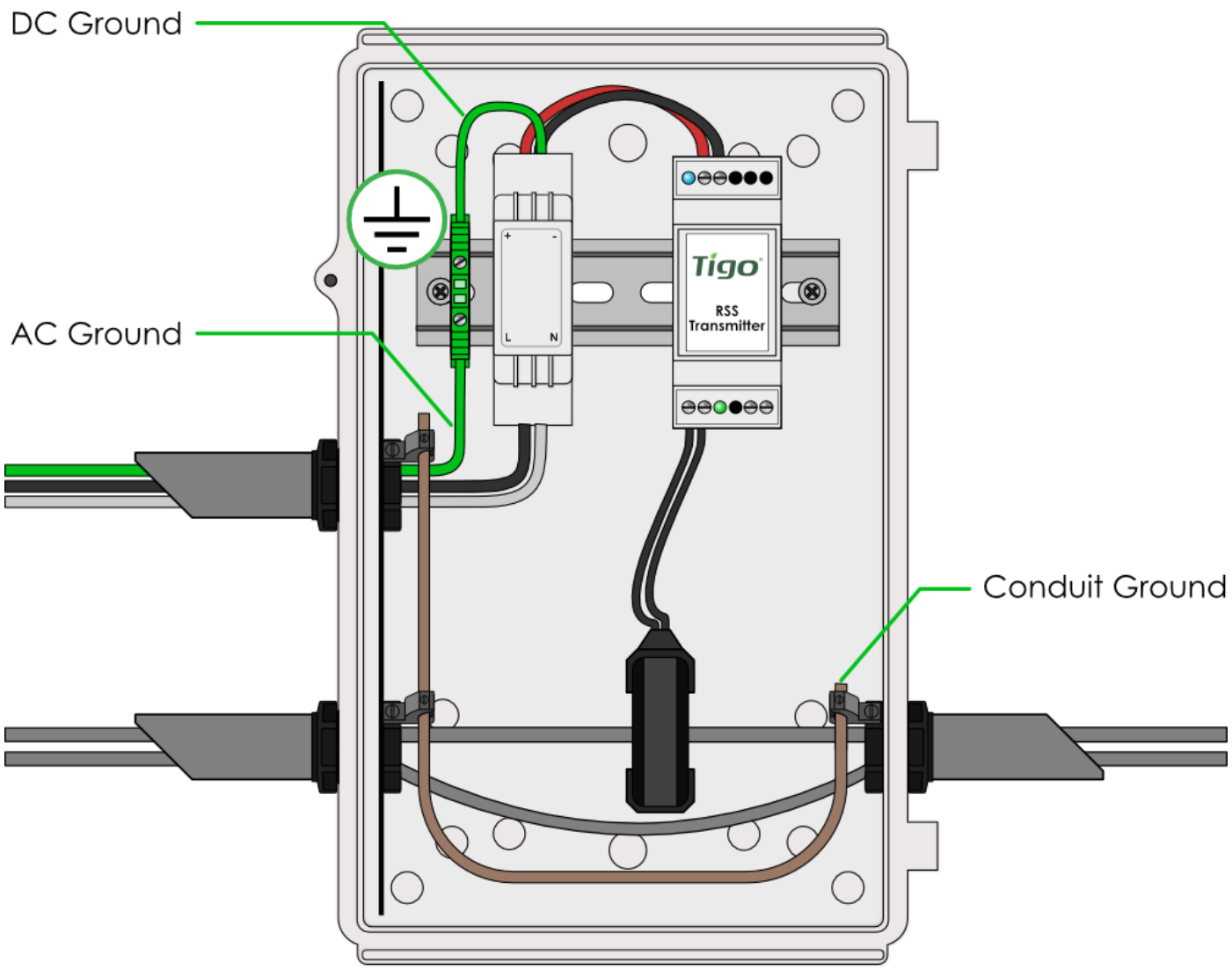
Install TS4-F **before** powering on RSS Transmitter

- Pass either positive **or** negative homerun(s) through RSS Core (CT)
    - Use the same polarity when passing multiple homeruns through the CT
- Connect wires to AC side of power supply

Homeruns through RSS Core must all be the same polarity
(all positive **or** all negative.)

Do not pass both homeruns of the same string through the CT.

3.3 RSS TRANSMITTER GROUNDING



Install TS4-F **before** powering on RSS Transmitter

- Connect AC and DC ground wires to DIN rail
- Ground all conduit connections
- Turn on AC power to power supply to activate Transmitter signal

Warning: nonmetallic enclosure does not provide bonding between conduit connections. Use grounding type bushings and jumper wires.

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APPENDIX

A. Product Specifications

B. Testing Rapid Shutdown

C. Troubleshooting

4.1 TECHNICAL SPECIFICATIONS – TS4-F / TS4-R-F

ELECTRICAL RATINGS

FIRE SAFETY
TS4-F / TS4-R-F

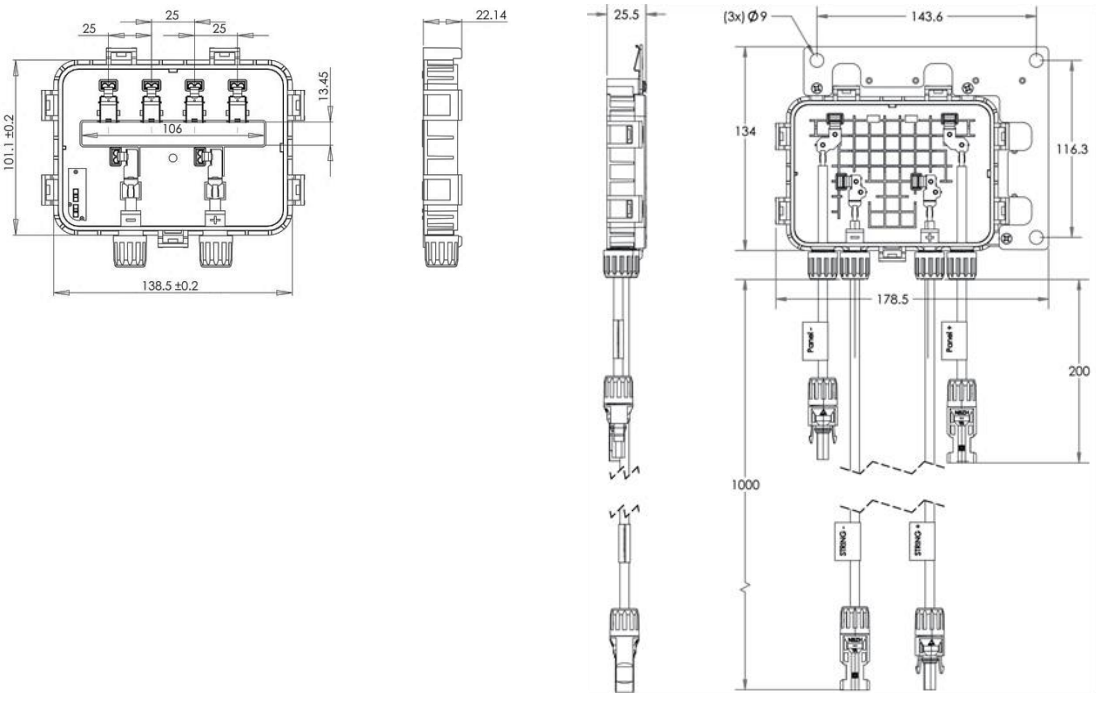
INPUT	
Rated DC Input Power	475W
Maximum Input Voltage at Lowest Temperature	90V
Max Continuous Input Current (I_{MAX})	12.5A
Maximum V_{OC} @ STC	75V
Minimum V_{MP}	16V
OUTPUT	
Output Power Range	0 - 475W
Output Voltage Range	0 – V_{OC}
Communication Type	Power Line Communication (PLC)
Rapid Shutdown UL Listed (NEC 2014 & 2017 690.12)	Any SunSpec-compliant signaling device
Impedance Matching Capability	No
Output Voltage Limit	No
Maximum System Voltage	1500V
Fuse Rating	20A

Specify system voltage when ordering (1000V / 1500V) for appropriate cables & connectors.

Rapid shutdown requires a SunSpec-compliant signaling device.

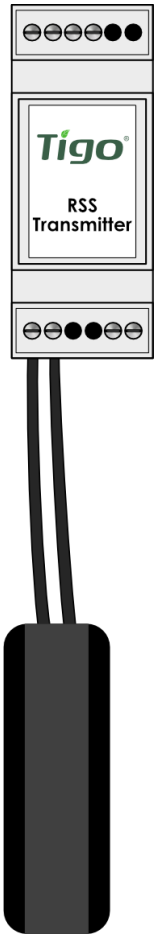
4.1.1 MECHANICAL SPECIFICATIONS – TS4-F / TS4-R-F

ELECTRICAL RATINGS	FIRE SAFETY TS4-F / TS4-R-F
MECHANICAL	
Operating Temperature Range:	-40°C to +70°C (-40°F to +158°F), RH < 85%
Storage Temperature Range:	-40°C to +70°C (-40°F to +158°F), RH < 60%
Cooling Method	Natural Convection
Dimensions (with cover)	178.5mm x 134mm x 25.5mm
Weight (base and cover)	670g
Outdoor Rating	IP68, NEMA 3R
CABLING	
Type	H1Z2Z2-K
Output Length	Standard 1.0m, other lengths on request
Cable Options	1000V rated 1500V rated
Cable Cross-Section	6.3 ± 0.3mm
Connectors	MC4, MC4 compatible, EVO2
UV Resistance	500hr with UV light between 300-400nm @65C
Maximum String Voltage	1500V UL/IEC[1]

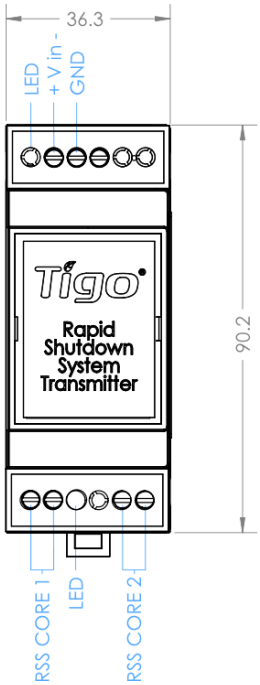


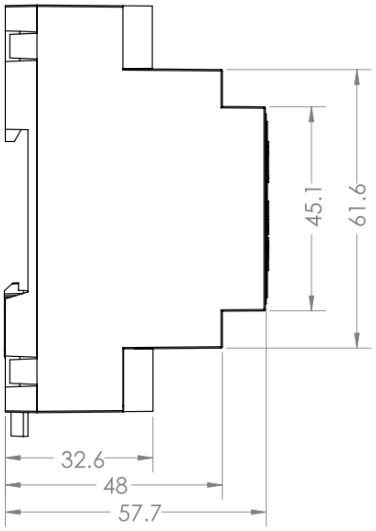
4.2 MECHANICAL SPECIFICATIONS – RSS TRANSMITTER

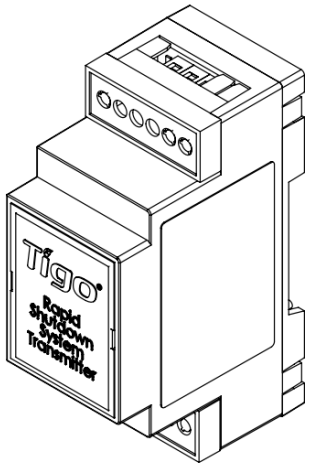
ELECTRICAL RATINGS	RSS Transmitter
INPUT	
Input Voltage	$12V_{DC}$
Input Current	1A
Average Supply Power	0.85W
Recommended Power Supply Rating	$12V_{DC}$ and 2A
Dimensions (Transmitter only)	90.2mm x 36.3mm x 57.7mm
RSS Core	
Max Current	150A per Core (Single Core: 150A, Dual Core: 300A)
Max MPPT String Voltage	$1500V_{DC}$
Internal Opening for Wires	27.5mm
Outside Dimensions	59mm
Max Number of Strings per Core	10
Max String Length	30 modules
Environmental	
Temperature	-40°C to 85°C



Recommended max. torque 0.79 N/m for wiring







All dimensions in mm.

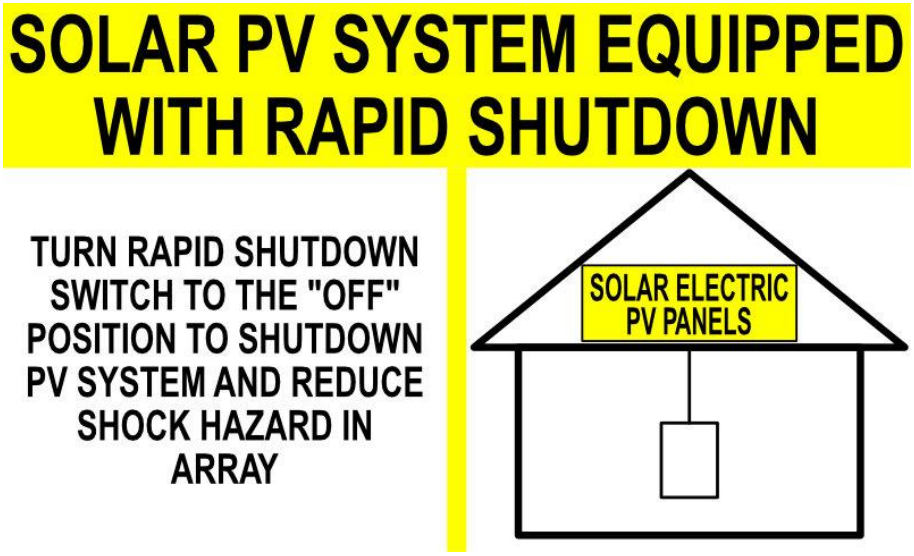
4.2 TESTING RAPID SHUTDOWN

TS4-F (or TS4-R-F) and a SunSpec-compliant signaling device are a solution to meet NEC 2014 & 2017 690.12 Rapid Shutdown requirements.

TS4-F and TS4-R-F units automatically enter rapid shutdown mode when the RSS Transmitter is switched off and resume energy production when power is restored to the RSS Transmitter.

Test your rapid shutdown system by switching off the AC power to the RSS Transmitter or SunSpec-compliant inverter.

TS4-F (or TS4-R-F) units will reduce their output to 0.6V when the transmitter is powered off.



Place Rapid Shutdown System label in proper location.

The RSS Transmitter control power supply MUST be on the same AC branch circuit as the inverter to meet rapid shutdown requirements.

CLICK HERE for more info about Rapid Shutdown

4.3 TROUBLESHOOTING

TS4-F/TS4-R-F:

- Output voltage without active transmitter signal is **0.6V**
- Output voltage with active transmitter signal will be normal module V_{MP} or V_{OC}
- If output is 0V contact Tigo support

Check that the system conforms to the design rules for TS4-F:

- Up to 10 strings per RSS Core (CT)
- Up to 30 modules per string
- String length up to 1000ft (**total** cable length from + to -)
- Homeruns through RSS Core must be the same polarity (all positive **or** all negative)

RSS Transmitter:

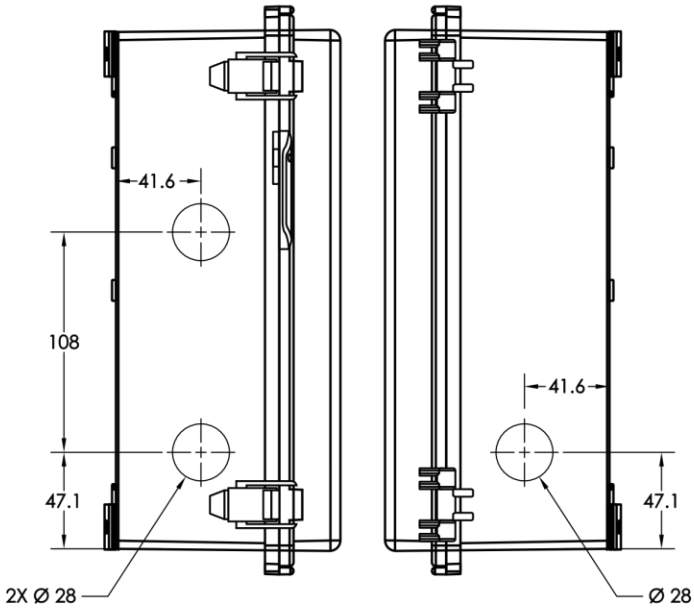
- Power LED should be lit and Signal LED should be blinking during operation
- Verify that RSS Core wiring is correct
- Power cycle RSS Transmitter if Signal LED is unlit
- While RSS Transmitter is powered off, string voltage should be (0.6V * number of modules)
- While RSS Transmitter is powered on, full string voltage should be present

Test individual strings with active RSS Transmitter one at a time in case of unexpected voltage.

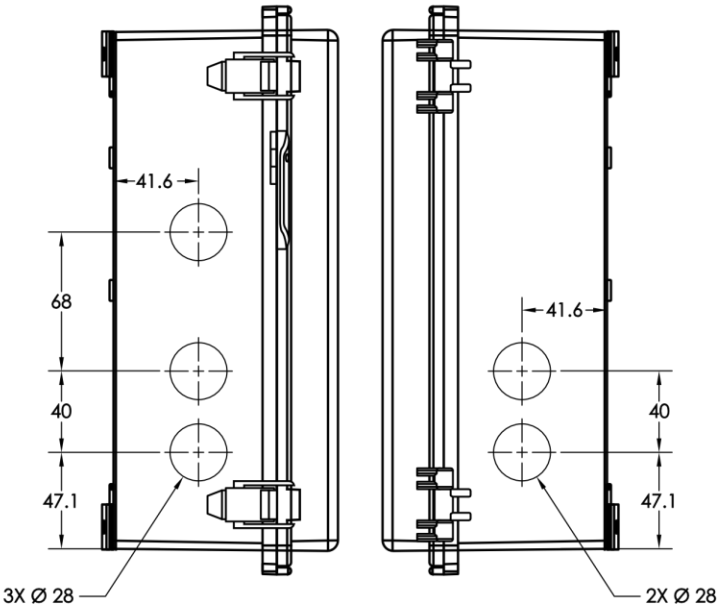
4.4 CONDUIT DRILLING GUIDE

Enclosure Drilling Guide for .75" Conduit

Single Core

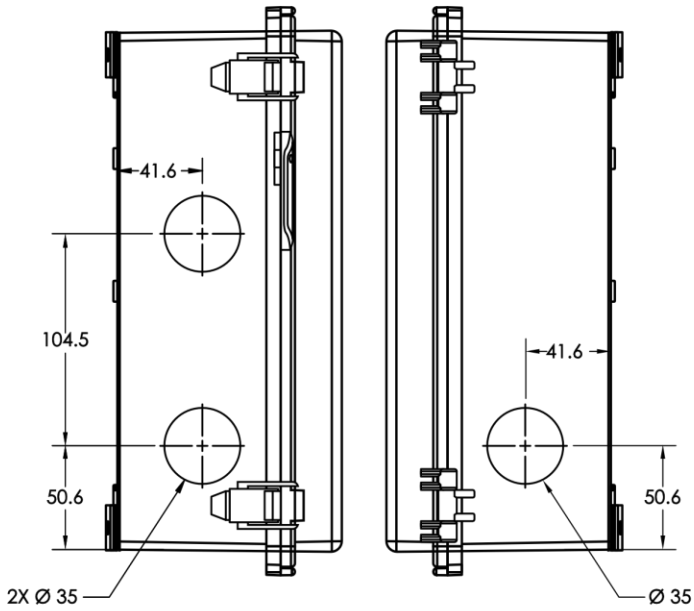


Dual Core

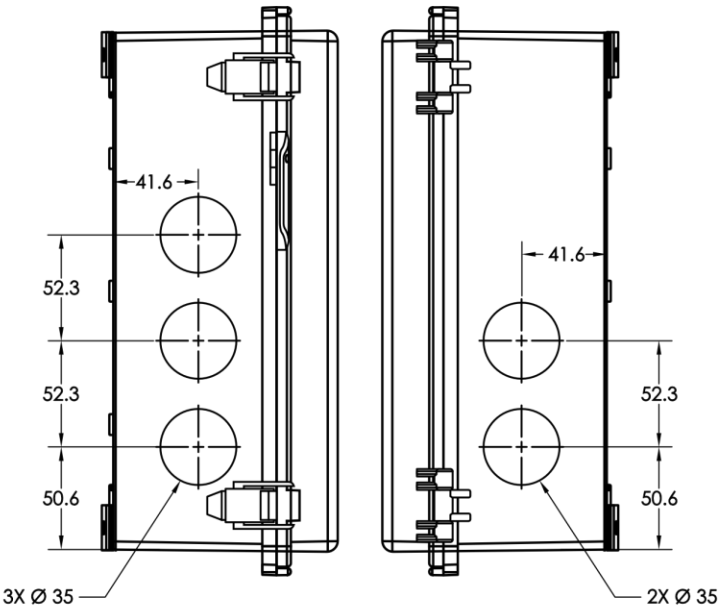


Enclosure Drilling Guide for 1" Conduit

Single Core



Dual Core



*all dimensions in mm

INSTALLATION COMPLETE

For more details on designing and installing solutions powered by Tigo, please visit:

- Tigo Academy
- Resource Center

Or contact us at:

- training@tigoenergy.com

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PV 2.0

ORDERING INFORMATION

Part Number	Description
TRANSMITTER	
490-00100-10	RSS Transmitter PCBA, Single RSS Core
490-00100-20	RSS Transmitter PCBA, Dual RSS Core
490-00000-10	RSS Transmitter DIN Rail, Single RSS Core
490-00000-20	RSS Transmitter DIN Rail, Dual RSS Core
492-00000-10	RSS Transmitter DIN Rail, Single RSS Core, Outdoor
492-00000-20	RSS Transmitter DIN Rail, Dual RSS Core, Outdoor
TS4-R-F	
478-00252-12	TS4-R-F, 1000VUL/TUV, 1.2M Cable, MC4
478-00252-02	TS4-R-F, 1000VUL/TUV, 1M Cable, MC4

For sales info:
sales@tigoenergy.com or 1.408.402.0802

For product info:
Visit www.tigoenergy.com/products

For technical info:
http://support.tigoenergy.com

For additional info and product selection assistance, use Tigo's online design tool at www.tigoenergy.com/design